

Claims

- 1 1. A gas purification system comprising:
- 2 a reactor having a volume and a wall, the wall having an interior side
- 3 and an exterior side, and a communicating portal therebetween for a mixed gas
- 4 flow;
- 5 a reaction catalyst coating in contact with the interior side of the wall;
- 6 a gas selective membrane within the reactor volume, said gas
- 7 membrane in contact with the mixed gas flow and selectively passing a
- 8 constituent gas of the mixed gas flow therethrough, whereby a raffinate of the
- 9 mixed gas flow is retained in contact with said membrane;
- 10 an outlet channel for removing said raffinate from contact with said
- 11 selective membrane; and
- 12 a passageway for the removal of the constituent gas from the interior of
- 13 said reactor.
- 1 2. The gas purification system of claim 1 further comprising a
- 2 heater in thermal contact with said reactor.
- 1 3. The gas purification system of claim 1 further comprising a
- 2 space between the reaction catalyst coating and the membrane.
- 1 4. The gas purification system of claim 3 wherein the space ranges
- 2 from 0.05 inch to 1.0 inch.

1 5. The gas purification system of claim 3 wherein the space ranges
2 from 0.3 inch to 0.6 inch.

1 6. The gas purification system of claim 3 wherein the space
2 comprises a flow distributor.

1 7. The gas purification system of claim 6 wherein the flow
2 distributor is selected from the group consisting of: packing, particulate, mesh
3 wire, wool, granule, pellet and fluidized catalyst.

1 8. The gas purification system of claim 6 wherein the flow
2 distributor is a multichannel monolith.

1 9. The gas purification system of claim 8 wherein the multichannel
2 monolith has channels ranging in diameter from 10 micrometers to 1
3 millimeter.

1 10. The gas purification system of claim 8 wherein the multichannel
2 monolith has channels ranging in diameter from 50 micrometers to 500
3 micrometers.

1 11. The gas purification system of claim 8 wherein the monolith
2 channels are coated.

1 12. The gas purification system of claim 8 wherein the monolith
2 channels are coated with a reaction catalyst.

1 13. The gas purification system of claim 8 wherein the monolith
2 channels are coated with a selective membrane.

1 14. The gas purification system of claim 8 wherein the monolith is
2 bonded to the reactor wall such that heat is conducted from the wall exterior to
3 the wall interior.

1 15. The gas purification system of claim 8 wherein the heating
2 means comprises a combustion catalyst.

1 16. The gas purification system of claim 15 wherein the combustion
2 catalyst is on the exterior wall of the reactor.

1 17. The gas purification system of claim 15 wherein the combustion
2 catalyst is on the exterior wall of a feed tube.

1 18. The gas purification system of claim 1 further comprising a flow
2 disruptor.

1 19. The gas purification system of claim 18 wherein the flow
2 disruptor is selected from the group consisting of: a bump, a protrusion, a
3 baffle and a helical tube.

1 20. The gas purification system of claim 2 wherein the heating
2 means comprises a sweep gas.

1 21. The gas purification system of claim 20 wherein the sweep gas
2 is inert.

1 22. The gas purification system of claim 21 wherein the sweep gas
2 is steam.

1 23. The gas purification system of claim 1 further comprising
2 partial pressure decreasing means.

1 24. The gas purification system of claim 23 wherein the partial
2 pressure decreasing means is sweep gas flow.

1 25. The gas purification system of claim 1 further comprising feed
2 liquid compression means.

1 26. The gas purification system of claim 1 wherein the membrane is
2 tubular.

1 27. The gas purification system of claim 1 further comprising a
2 plurality of the membranes.

1 28. The gas purification system of claim 1 wherein the membrane is
2 hydrogen selective and the constituent gas is hydrogen.

1 29. The gas purification system of claim 1 wherein the catalyst
2 coating comprises a methanol reforming catalyst.

1 30. The gas purification system of claim 1 wherein the catalyst
2 coating comprises an ammonia cracking catalyst.

1 31. The gas purification system of claim 1 wherein heat is provided
2 by catalytic combustion.

1 32. The gas purification system of claim 1 wherein said reactor
2 further comprises a heat transfer fin on the exterior surface thereof.

1 33. A gas purification system comprising:

2 a reactor operating above room temperature having a volume and a
3 wall, the wall having an interior side and an exterior side, and a communicating
4 portal therebetween for a mixed gas flow;

5 a gas selective membrane within the reactor volume, said gas
6 membrane in contact with the mixed gas flow and selectively passing a
7 constituent gas of the mixed gas flow therethrough, whereby a raffinate of the
8 mixed gas flow is retained in contact with said membrane;

9 an outlet channel for removing said raffinate from contact with said
10 selective membrane;

11 a catalyst in contact with the exterior side of said reactor that induces an
12 exothermic combustion reaction with the raffinate; and

13 a passageway for the removal of the constituent gas from the interior of
14 said reactor.

1 34. The gas purification system of claim 33 further comprising an
2 insulating jacket surrounding said reactor, the jacket having an oxygen
3 containing gas flowing therethrough.

1 35. The gas purification system of claim 33 further comprising a
2 plurality of the membranes.

1 36. The gas purification system of claim 33 wherein the membrane
2 is hydrogen selective and the constituent gas is hydrogen.

